BZ/M348 and BZ548 Theory of Population and Evolutionary Ecology
Fall 2021

Instructor: Professor Lockwood

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Office hours:

- By appointment via Calendy Links:
  - Individual meeting: https://calendly.com/drlockwood/bz348-office-hours-individual-appointment
  - Group meeting: https://calendly.com/drlockwood/office-hours-bz348-group-meeting

Lecture: MWF 1:00 – 1:50 PM; Biology 136
Lab: Thursdays 3-6 PM; Biology 136

Text:

There is no required text but there are a host of good books (each with their own strengths). You might want to check some out (or buy the ones that work well for you):

Otto, S.P. and T. Day. 2007. A Biologist's Guide to Mathematical Modeling in Ecology and Evolution. Princeton University Press, Princeton, New Jersey.
Bulmer, M. 1994. Theoretical Evolutionary Ecology. Sinauer Associates, Sunderland, Massachusetts.
Case, T.J. 2000. An Illustrated Guide to Theoretical Ecology. Oxford University Press, New York.
Edelstein-Keshet, L. 2005. Mathematical Models in Biology. SIAM, Philadelphia.
Gotelli, N.J. 2008. A Primer of Ecology, 4th Edition. Sinauer Associates, Sunderland, Massachusetts.
Hastings, A. 1997. Population Biology: Concepts and Models. Springer-Verlag, New York.
Murray, J.D. 2007. Mathematical Biology I, 3rd Edition. Springer-Verlag, New York.
Ryan, M. 2003. Calculus for Dummies. Wiley Publishing, Inc. Indianapolis, Indiana.

ALSO: You will need to have access to a computer with the ability to run Matlab (either downloaded and installed or the web-based version). We will use this program in lab – with the goal of becoming more proficient at creating and manipulating models and learning the basics of coding.

Canvas: You will find all assignments, labs, and papers to be read on Canvas.

Course Description

The principal objective of this course is to familiarize students with the theory of population and evolutionary ecology. Students will gain enough background to read theoretical population and evolutionary ecology literature, do simple modeling, and springboard to more complex theory if desired. This course is a strong mix of mathematics and ecology. The students in the course typically have some knowledge in one of these areas (for example, calculus and linear algebra from mathematics; or ecology and evolution from the biological side). Few students will have strong experience in both and some students have the prerequisite calculus and no ecology. We work with all backgrounds to develop new skills, knowledge and understanding throughout the semester. The goal is to learn about theoretical ecology and begin to create models. The learning curve is steep early in the semester and diligence and patience will pay off.

Grading:

Homeworks	40%
Lab solutions/Writeups	20%
Final Project	20%
In-class discussions	5%
Final Exam	15%
Total:	**100%**

A = greater than 90%;
B = between 80% and 89.9%;
C = between 70% and 79.9%;
D = between 60% and 69.9%;
F = less than 60%;

Homeworks:
Homeworks will be assigned throughout the semester. I will drop the lowest two. All your homeworks will be uploaded to Canvas and should be typed. There will be equations and graphs required and these should also be done with software (not hand-drawn or written). This will allow you to become more proficient with the Word Equation Editor or LaTeX. The questions will be a mix of mathematics and applying modeling concepts to specific types of ecological systems.

In class discussions:
During the semester we will have papers that you will read and then we will have discussions of the papers. The discussions will be led by a or or two students each. You will receive points for your leading of the discussion on your day. We will go over how to read scientific literature and how to lead a discussion during the first week of class.

Final project:
The final project will be taking a system of your choosing (actual population, community, or a hypothetical system – students often choose systems from science fiction works that they find interesting) and creating or extending a model to explore the system. The write up for the final project will be in the format of a journal article.

Final exam:
The final exam is a take-home test. It is posted after classes end on the Friday before final exam week. It is due by the end of the time scheduled for the final exam in the course according to the registrar's schedule.

Lab solutions/writeups:
Weekly labs will allow us to explore the implementation of ecological models through coding them in Matlab. Students are not expected to have programming skills and the labs will start with the basics. Early on, much of the model details will be provided and exploration of varying parameters, presenting data visually, and developing sound programming practice will be the goal. As the semester progresses, students will grow in the amount of programming they do for each lab. Labs will be written up in different styles – simple answers to a series of questions, presenting the results in the form of a white paper for policy makers, or in the form of a piece that might be found in *The Conversation* – expressing the material to a general audience.

Academic Integrity

At minimum, academic integrity means that no one will use another's work as their own. The CSU writing center defines plagiarism this way:

> Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. Done on purpose, it is cheating. Done accidentally, it is no less serious. Regardless of how it occurs, plagiarism is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."

If you plagiarize in your work you will lose credit for the plagiarized work, you will fail the assignment, and you may fail the course. Plagiarism could result in expulsion from the university. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (see page seven, column two: http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf).

Of course, academic integrity means more than just avoiding plagiarism. It also involves doing your own reading and studying. It includes regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students.

Animals in the classroom:
In accordance with University Policy, the only animals allowed in the classroom are Service Dogs as defined by the Americans with Disabilities Act. Please note that pets or Emotional Support Animals are expressly forbidden from all non-residential university buildings. If you bring a dog to class and it is not a Service Dog, you will be asked to leave and to not bring the dog to class again. Animals not trained for public settings are often very stressed in such environments. It is not fair to the animal or the class to put an animal through that experience.

Grading and absence policy

If you are ill, have a family emergency, or must be away for a University-sponsored event, then Dr. Lockwood must be given written verification of the absence, or a letter from the coach **in advance** when circumstances allow. There will be no makeup examinations. See Dr. Lockwood to discuss the implications of this absence for your grade.

Late homework will be deducted points (10 points until noon on the due date and 25 points if turned in by end of day - midnight). Homework will be due 11:59pm on Fridays.

Students regularly have questions about grading of homework and labs, and that is fine (in fact, it is really good to understand what you missed and why you missed it. Dr. Lockwood will gladly re-grade any question(s) you feel are needed; however, it is your responsibility to follow these rules:

1. When labs/homeworks are graded and the grades posted to Canvas, you have 24 hours to identify arithmetic errors on my part.
2. If you would like to have an exam or homework question re-graded, you must submit it with a written explanation of your arguments and the entire lab or homework within one week after it was returned in class. Please note, using websites to support your argument that are not peer-reviewed or based on sound science will not receive any points back (Hint: you won't find answers to the homeworks by googling for them).
3. I will gladly speak with you about the material thereafter but absolutely no grade changes will be made once the one-week period has elapsed.

Topic Areas:

1:	Single Species-continuous time, ecological systems. Linear, density independent systems; density dependent systems; Explicit solutions; Equilibria; Linearization; Stability; Qualitatively different dynamics
2:	Single Species-discrete time, ecological systems. Density dependent and density independent growth; Chaos;
3:	Single Species - spatial explicit systems. Metapopulations; Integrodifference equations; cellular automata; Graph/Network Theory
4:	Age/stage structured populations. Life tables; size structured models; estimating population growth rates
5:	Disease dynamics. SIR models and extensions; disease networks;
6:	Interacting populations. Isoclines, equilibria, linearization, competition, predation, foodwebs and stability.
7:	Intro to evolution
8:	Selection
9:	Drift
10:	Mutation/Mutation-selection balance

FINAL EXAM: The final exam is a take home test. It is due at the end of the final exam time posted for the course.